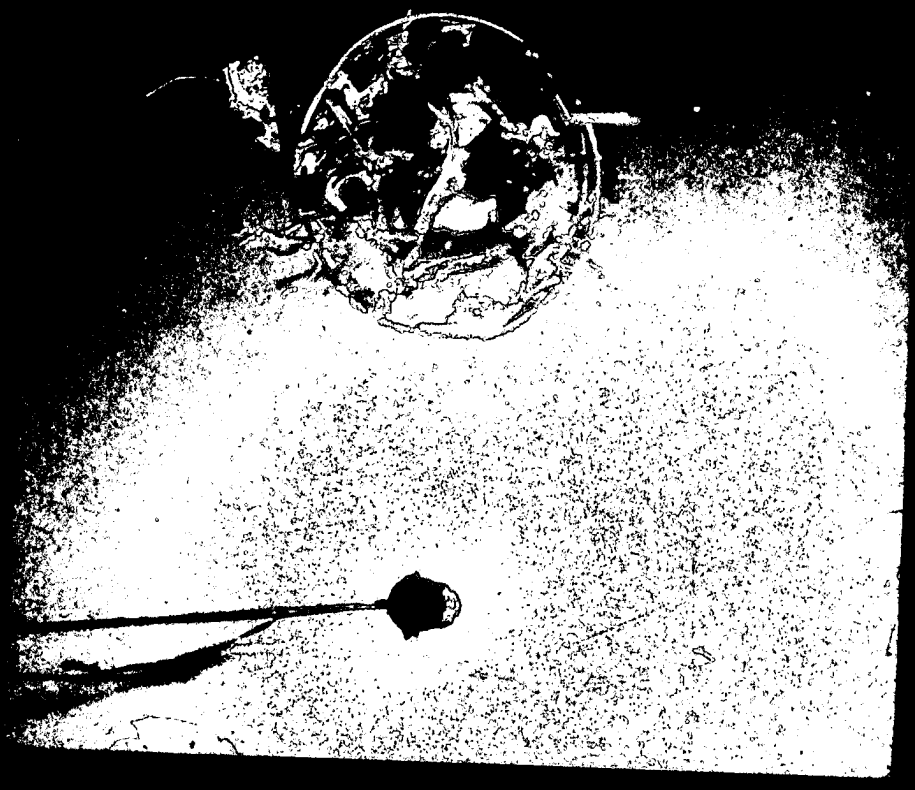
COMOR



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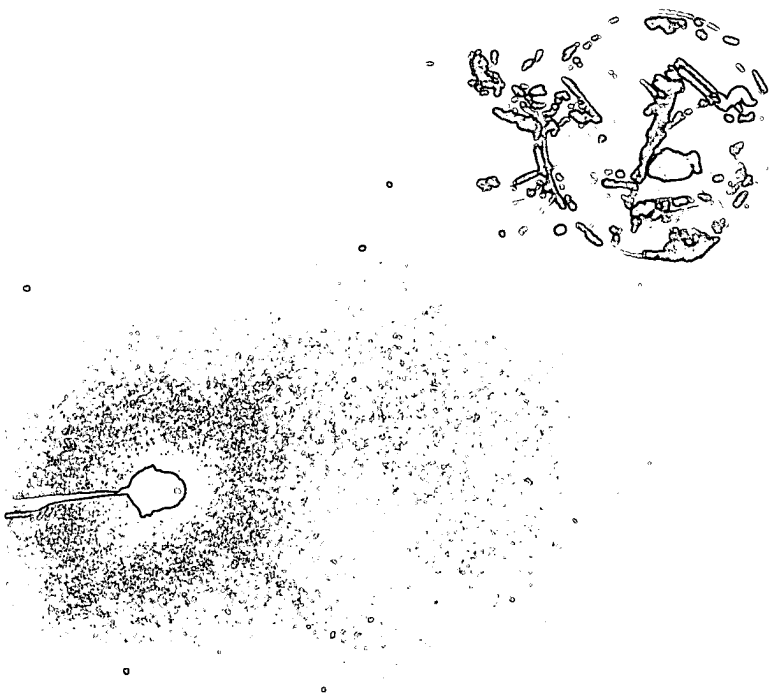

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This document contains information referring to IDEALIST, CORONA, ARGON, & MURAL

This material contains information affecting the national defense of the United States within the meaning of the espionage laws, Title 18, USC, Secs. 793 and 794, the transmission or revelation of which in any manner to an unauthorized person is prohibited by law.

25X1

THIS DOCUMENT CONTAINS CODE WORD MATERIAL

WARNING

This document contains classified information affecting the national security of the United States within the meaning of the espionage laws, US Code Title 18, Sections 793, 794, and 798. The law prohibits its transmission or the revelation of its contents in any manner to an unauthorized person, as well as its use in any manner prejudicial to the safety or interest of the United States or for the benefit of any foreign government to the detriment of the United States.

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THE CHARTER ESTABLISHING THE COMMITTEE ON OVERHEAD RECONNAISSANCE

DCID No. 2/7
(New Series)

DIRECTOR OF CENTRAL INTELLIGENCE DIRECTIVE NO. 2/7

COMMITTEE ON OVERHEAD RECONNAISSANCE (COMOR)

(Effective 9 August 1960)

Pursuant to the provisions of NSCID Nos. 1, 2, 3 and 6, and for the purpose of providing a focal point for information on, and for the coordinated development of foreign-intelligence* requirements for, overhead reconnaissance projects and activities of the Government over denied areas** (including foreign-intelligence requirements during research and development phases of such projects and activities) a Committee on Overhead Reconnaissance (COMOR) of the U. S. Intelligence Board is hereby established.

1. For the purposes of this directive the term "overhead reconnaissance" includes all reconnaissance for foreign-intelligence purposes by satellite, or by any vehicle over denied areas, whether by photographic, [redacted] or other means, but does not include reconnaissance and aerial surveillance in direct support of actively combatant forces. 25X1

2. The Committee shall coordinate the adaptation of priority foreign-intelligence objectives and requirements established by USIB, members of USIB, or other committees of USIB, to the capabilities of existing and potential overhead reconnaissance systems; and shall examine and make recommendations, as appropriate, on such related matters as dissemination and any special security controls required, but shall not undertake to provide operational guidance.

[redacted] 25X1

3. The Committee on Overhead Reconnaissance (COMOR) shall be composed of designated representatives of Intelligence Board departments and agencies. Representatives of other agencies may be invited by the Chairman to participate in selected discussions as agreed by the Committee.

4. The Chairman of the Committee shall be designated by the Director of Central Intelligence in consultation with and with the concurrence of the Intelligence Board.

ALLEN W. DULLES
Director of Central Intelligence

* As distinguished from operational "early warning" information and other operational-support intelligence.

** For purposes of this directive "denied areas" include all territory and territorial waters claimed by members of the Sino-Soviet Bloc, as well as such other areas of priority intelligence interest as may be determined by USIB.

THE COMMITTEE ON OVERHEAD RECONNAISSANCE (COMOR)

The graphic on the facing page briefly depicts the operation of the Committee on Overhead Reconnaissance (COMOR). The members shown across the top of the chart are the designated representatives from the Intelligence Staff or Board of his Agency or Department, and, specifically, the Intelligence Officer concerned with requirements.

The COMOR normally meets once each two weeks. However, in certain instances, it may meet at any time. As an example, a certain vehicle may have performed reconnaissance over an area designated by COMOR, and the COMOR might gather to determine if the product obtained was sufficient to satisfy the requirements or whether the vehicle should be tasked again.

Any one of the designated members of the COMOR may contact the Chairman and request a meeting to consider urgent requirements for his Department.

The distribution, number of copies of film, prints and reports among the members is determined by the COMOR. The security classification, numerical clearance limitations, sanitization, and methods of handling the CIA product are also COMOR responsibilities.

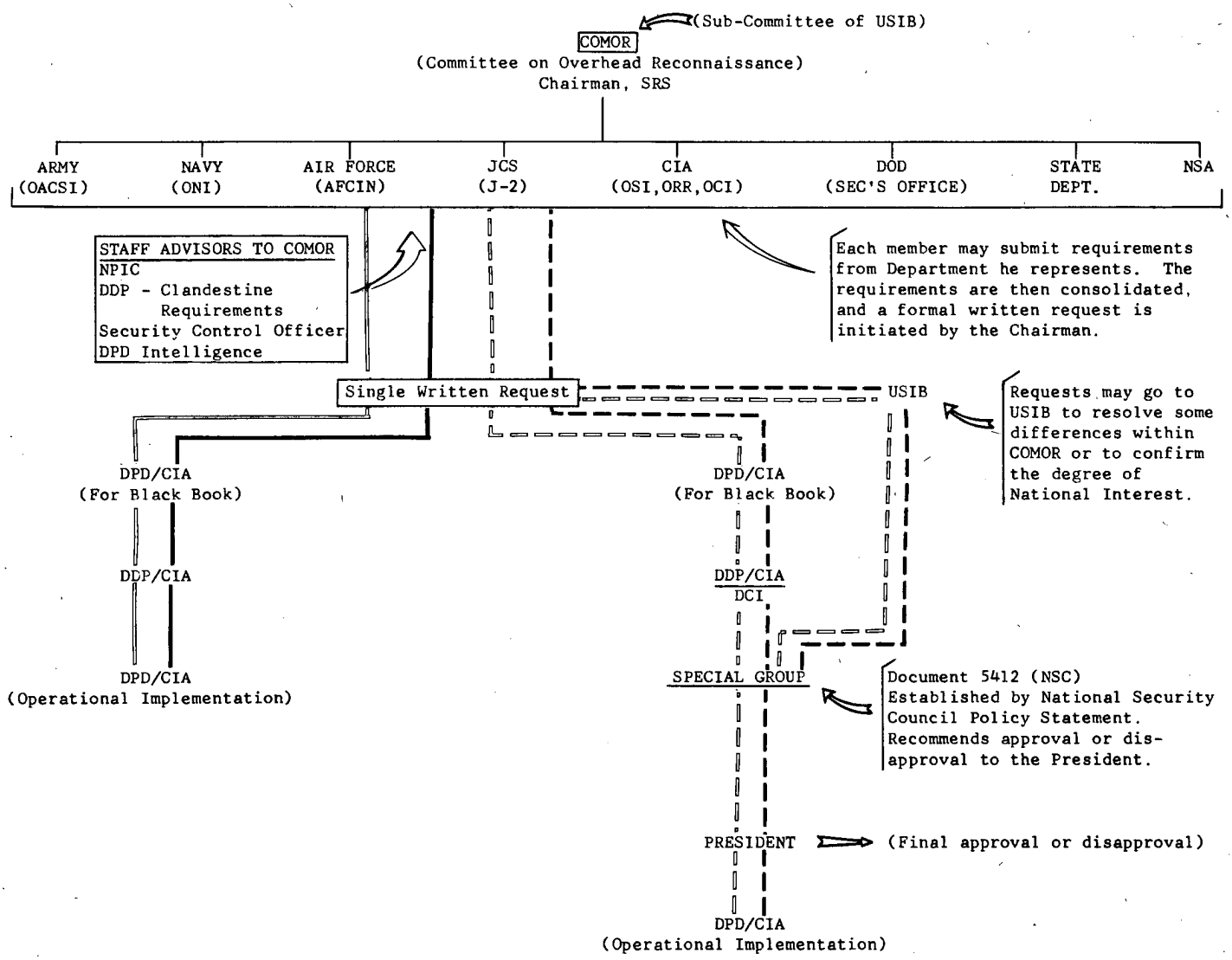
An informal committee may be established within COMOR for various purposes at various times. Such committee may be formed to consolidate individual requirements of the members into a single requirement to be placed before the COMOR; it may also perform certain studies and research in order to acquaint the COMOR with factors sufficient to affect a decision.

Once a COMOR requirement has been established and a written request for approval made, the requirement paper is submitted to DPD for possible elaboration through use of charts and substantiating data. The request then, usually in the form of a "black book", is sent to the Director's Office for endorsement. After the Director or his Deputy has endorsed the request, the paper or book is then sent to the Special Group for consideration. The Special Group is a committee formed at the direction of the National Security Council to advise the President on all clandestine overflight programs.

The paper and the Special Group's recommendation then go to the Military Representative of the President (General Maxwell Taylor), who studies the paper and the attached recommendations and then advises the President, who in turn makes the final decision for approval or disapproval. The COMOR paper then returns to DPD for implementation, if approved.

In the event a program [redacted] is approved, it is usually authorized to operate over a certain period of time at a specified frequency of overflight. In this case the COMOR paper simply goes to the Director and DPD for implementation. 25X1

MECHANISM AND PROCEDURES FOR REQUIREMENTS AND APPROVAL FOR OVERFLIGHT RECONNAISSANCE OF DENIED AREAS



Key

CORONA/ARGON Satellites
U-2 TACKLE
Other

Note: Dashed lines indicate those programs for which no approval has ever been given, or for which approval has been given for a specified period of time.

Solid lines represent requests for coverage involving a vehicle for which approval has been given to operate over a specified period of time.

Abbreviations

OACSI - Office of Ass't. Chief of Staff, Intelligence, A
ONI - Office of Naval Intelligence
AFCIN - Office of Ass't. Chief of Staff, Air Force
J-2 - Joint Chiefs of Staff, Intelligence
OSI - Office of Scientific Intelligence, CIA
ORR - Office of Research and Reports, CIA
OCI - Office of Current Intelligence, CIA
DOD - Department of Defense
NSA - National Security Agency
SRS - Special Requirements Staff, CIA
DCI - Director of Central Intelligence
NSC - National Security Council
DPD - Development Projects Division, CIA
DDP - Deputy Director (Plans), CIA
USIB - United States Intelligence Board
NPIC - National Photographic Interpretation Center

This document contains information referring to IDEALIST

BACKGROUND OF THE PROGRAM

In 1954, Mr. Clarence L. (Kelly) Johnson of Lockheed Aircraft Corporation presented a drawing board version of the U-2 aircraft to the U. S. Government for their consideration of the vehicle as a reconnaissance collection aircraft. Mr. Johnson pointed out that the aircraft would be excellent for this type of work because of its high altitude, long range characteristics. The Agency and the USAF, impressed with the potential employment of the aircraft, sought appropriate approvals for the program and subsequently embarked on a joint Agency-USAF project. It was agreed that the Agency would generally run the program with logistical and technical support furnished by the USAF in accordance with joint policy guidance. For purposes of administering and controlling the project, the Agency created a separate staff to contract for the development of the aircraft, monitor the development activity, administer all personnel involved, establish operational policies and procedures, and provide a tightly controlled, secure program. Simultaneous with the creation of a mechanism for monitoring development and operational use of the aircraft, steps were taken to establish an intelligence community effort for identification of intelligence requirements and processing, interpretation and distribution of the final product by the most expeditious and secure means.

Initial development activities began at Lockheed and subsequently expanded to a test site facility [redacted] This site was used for flight testing of the vehicle, equipment check out and pilot transition and training. 25X1

[redacted] 25X1

As soon as the initial U-2's became operationally ready, plans were made for the deployment of one unit to a forward overseas location. In May of 1956 the first U-2 unit, [redacted] Due to the political climate in the host country at that time, the unit was subsequently moved to Wiesbaden AFB, Germany from which location overflight operations began with the first overflight on 20 June 1956. 25X1

In August of 1956, a second unit was deployed to Adana, Turkey and in February of 1957 a similar detachment was sent to Atsugi, Japan. In September of 1956, the detachment at Wiesbaden moved [redacted] where it remained until November of 1957 at which time the unit was moved back to the U. S.. The Adana detachment remained at that location until the fall of 1960 when the major part of the detachment returned to the U. S., leaving a small holding force at Adana in anticipation of future activities from that area. The Japan detachment also returned to the U. S. in the fall of 1960. The returning detachments located at Edwards AFB joining the remainder of personnel and equipment that had been moved from the AEC test site to Edwards AFB in June of 1957. 25X1

Initially, it was thought that overflights would be conducted direct from the overseas U-2 bases as were the first flights from Wiesbaden [redacted] and isolated flights from Adana and Atsugi. Subsequently, it was decided that the best coverage could be obtained by staging from other bases closer to the target areas. The locations used on these staging operations were [redacted] From these staging locations and the overseas bases themselves, fifty-two flights were made over Sino-Soviet bloc countries. Numerous other periphery flights were made as well as Middle East and Southeast Asia coverage. 25X1

As well as the flights mentioned above, which were mainly photo-reconnaissance [redacted] flights, many training flights were conducted including legitimate weather reconnaissance [redacted] Specialized mission flown from Japan to photography typhoons, [redacted] proved to be of value to the AWS typhoon monitoring program and likewise to the Japanese Meteorological Society. Other by-products of the program were the development of more sophisticated collection equipment and electronic countermeasures mechanisms which continued concurrently with performance of the primary mission. 25X1

THE 1 MAY INCIDENT

In the early part of May 1960, the U-2 Program, heretofore a covert intelligence program, became a topic of conversation in every corner of the world. NBC described their television expose "White Paper" of the U-2 incident as the most widely listened to documentary program of 1960. U-2 has become a household word and Francis Gary Powers a more widely known individual than many heads of State.

Little did Mr. Powers know that he would obtain such notoriety when he joined the program in 1956. At that time he was a USAF pilot at Turner AFB in Albany, Georgia who, motivated by a combination of money and patriotism, chose to join the novel U-2 group. For cover purposes, Mr. Powers resigned from the USAF and ostensibly went to work for Lockheed Aircraft Corporation. He was trained to fly the new aircraft [redacted] and exhibited great skill in the mechanics of flying and navigation. Later, after receiving appropriate Escape and Evasion training at a cover Agency location, Mr. Powers departed for duty with the operational U-2 unit at Adana. 25X1

Prior to 1 May 1960, Mr. Powers had flown two missions over Sino-Soviet bloc countries and approximately twenty-three missions over the Middle East and close to the Soviet border as well as numerous training sorties. His conduct and demonstrated abilities while on these missions were praised by his supervisors and considered to be excellent. Thus, Mr. Powers was probably one of the best qualified for the 1 May flight.

Prior to the flight, Mr. Powers was briefed on his flight plan [redacted] He was also briefed on the targets and locations of possible opposition fighter and ground to air missile defenses. As part of the regular pre-mission briefing, Mr. Powers was reminded of the provisions of Operations Policy Letter No. 6: Subject: Intelligence Briefings, Including Policy for Pilots Forced Down in Hostile Territory. A portion of this letter is quoted below: 25X1

"4. Conduct and Procedure in Event of Capture:

a. If evasion is not feasible and capture appears imminent, pilots should surrender without resistance and adopt a cooperative attitude toward their captors.

b. At all times while in the custody of their captors pilots will conduct themselves with dignity and maintain a respectful attitude toward their superiors.

c. Pilots will be instructed that they are perfectly free to tell the full truth about their mission with the exception of certain specifications of the aircraft. They will be advised to represent themselves as civilians, to admit previous Air Force affiliation, to admit current CIA employment, and to make no attempt to deny the nature of their mission. They will be instructed, however, to understate moderately the performance of the

aircraft in a plausible fashion. (It is recommended that stated capabilities should be decreased from actual capabilities by 10,000 feet altitude and 500 miles range.) Such briefing should safeguard pilots from extreme treatment by permitting them the greatest possible latitude in responding to interrogations.

d. Pilots should make every effort to avoid discussing or divulging information given them during the tactical intelligence briefings on defensive capabilities: i.e., AOB, ROB, etc.

e. With regard to signed confessions, radio interviews and similar activities which could be exploited for their propaganda value, all efforts must be made to resist."

After his briefings, Mr. Powers took off and proceeded along his prescribed course until he reached Sverdlovsk where he experienced difficulties. Many theories have been advanced as an explanation for what occurred at Sverdlovsk, however, as of this writing, no one can be sure of what actually happened. A review of the best intelligence available indicates, however, that, over Sverdlovsk Mr. Powers climbed from his programmed altitude to a point from which he made a controlled descent to approximately 37,000 feet at which point he remained for a brief period before the aircraft descended to the ground. The Soviet Union claims that a direct hit from one of their ground to air missiles was responsible for the initial descent of the aircraft from maximum altitude. U. S. authorities do not know the exact cause of the descent but speculate that it could have been a flameout or other engine malfunction which could easily occur at that maximum altitude. Though most U. S. authorities do not agree with the direct hit theory, they do not discount the possibility of an indirect hit by a ground to air missile or possibly an air to air missile fired from a Soviet fighter.

From May until August of 1960, Mr. Powers was in the hands of the Soviet Authorities without contact with any American Officials. During that period, it appears that Mr. Powers acted in accordance with the instructions cited in Operations Policy Letter No. 6. His conduct plus an extensive investigation by the Agency C.I. Staff give the Agency no reason to consider Mr. Powers an unloyal American.

In relation to Mr. Powers' future behavior, it might be pointed out that he has remained under Soviet control without contact with the outside world since his trial in August of 1960 and, therefore, his attitudes cannot be predicted.

PRESENT STATUS AND FUTURE OF THE PROGRAM

Presently, the Agency maintains two U-2 units: one at Edwards AFB [redacted] The Edwards AFB unit is prepared for stagings to any part of the world to meet "crash" collection requirements arising out of cold war limited war situations. Two examples of this type of staging mission that has been performed by the Edwards unit were the coverage of Cuba and Laos conducted in the fall of 1960. 25X1

The Edwards unit is also prepared to respond immediately to any all out effort on the part of the U. S. to determine the imminence of surprise attack.

[redacted] 25X1

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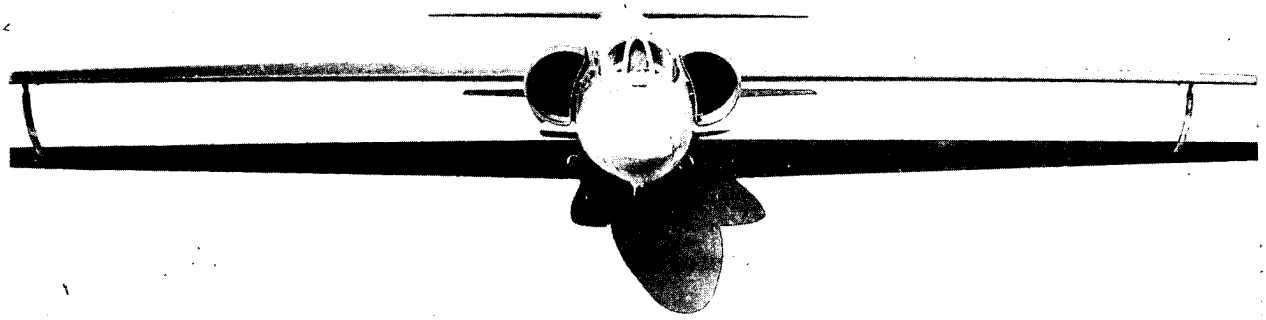
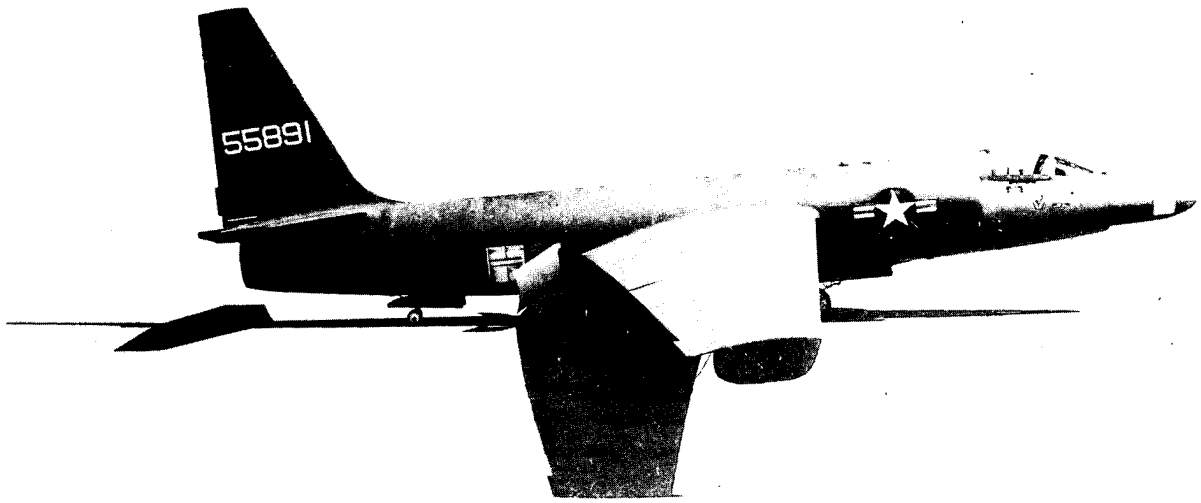
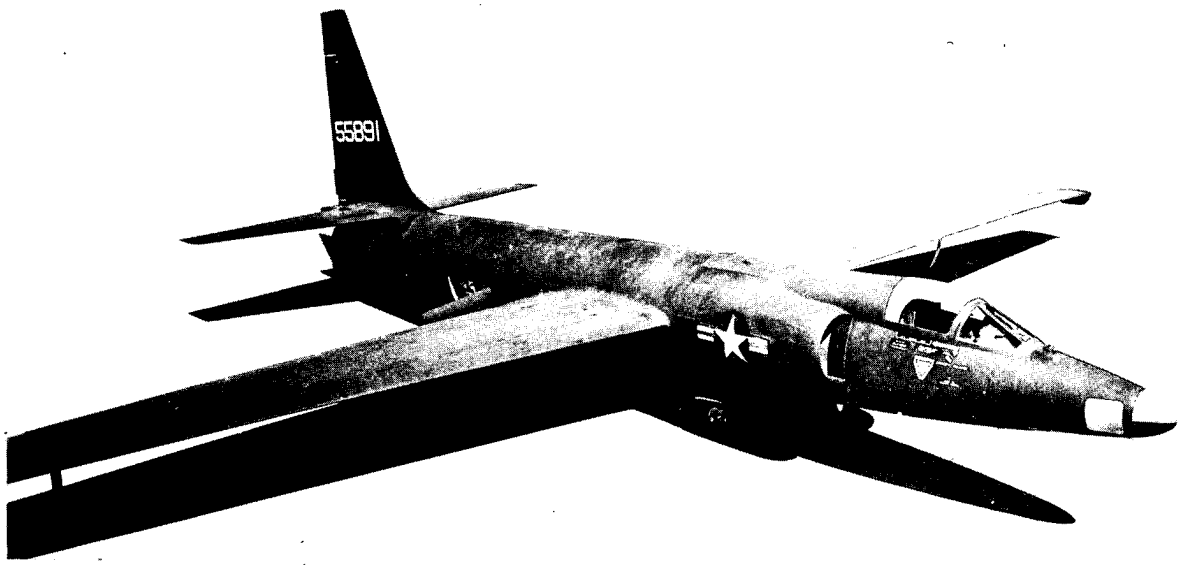




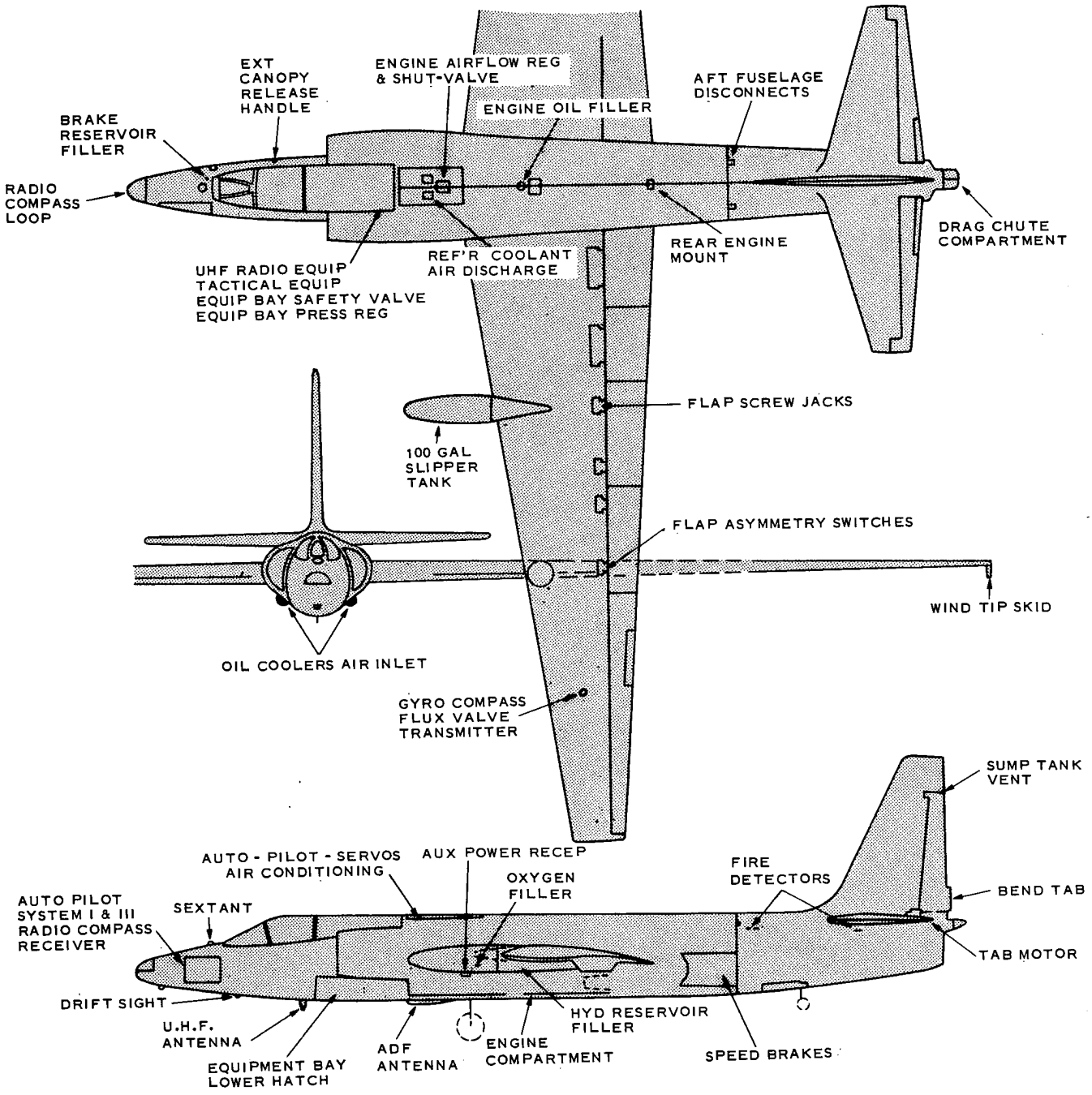


U-2C (J-75 ENGINE)

GENERAL

The U-2 is a single place, jet propelled aircraft designed for very high altitude, long range operation. The basic configuration is fitted for photo reconnaissance. Various other equipment can also be installed for special purposes.

Wing Area	600 sq. ft.	Empty weight	12,119 lbs. (approx.)
Wing Span	80 ft.	Full fuel weight	22,865 lbs.
Aspect Ratio	10.67	Rated Static Thrust	16,000 lbs. at sea level
Wing Average Thickness	7.8%	Time to climb	0-70M, 3 hrs 24 mins (1300 nm)
Fuselage Length	49.7 ft.	Maximum Range	3400 nm (no refueling)



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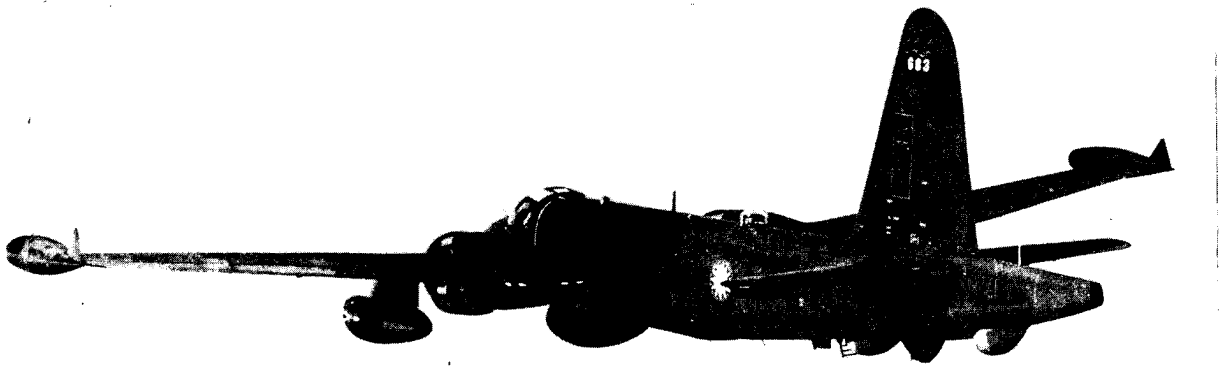
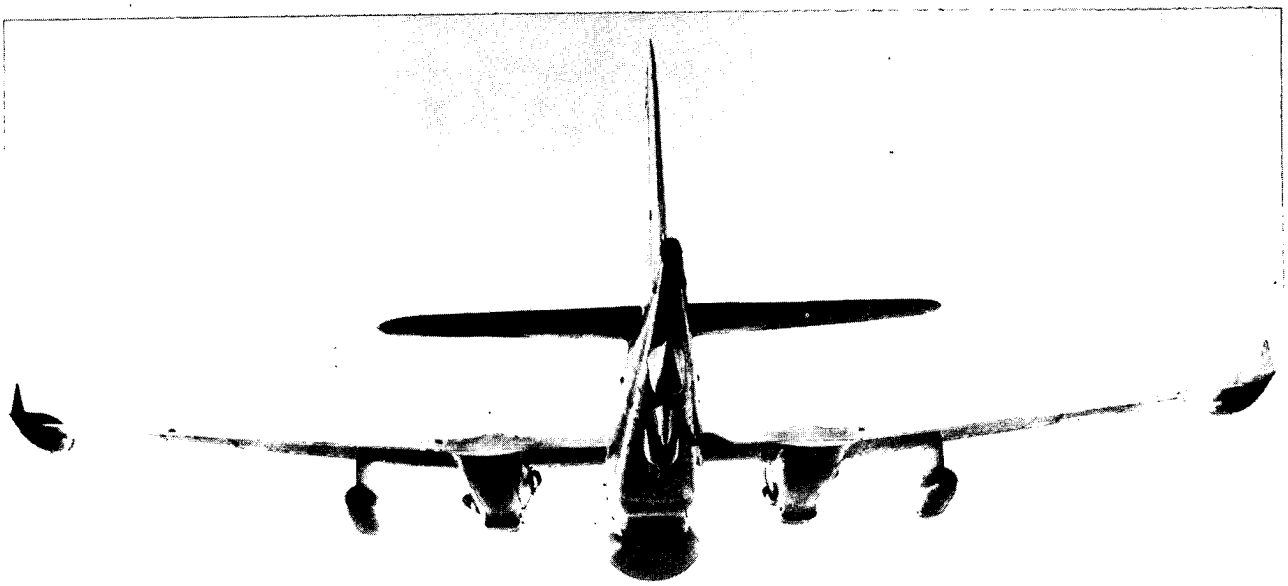
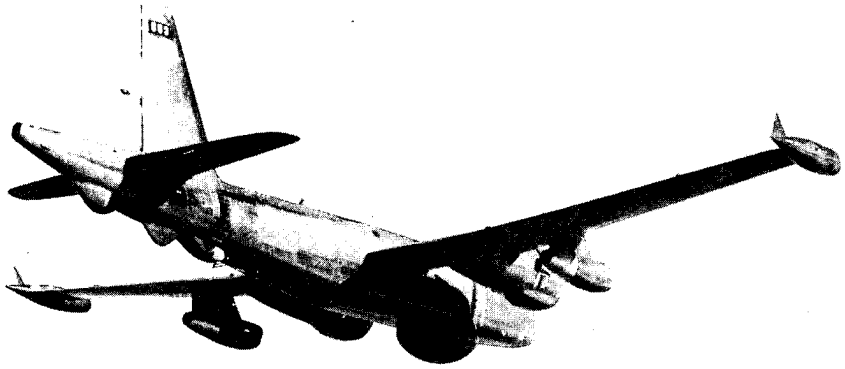
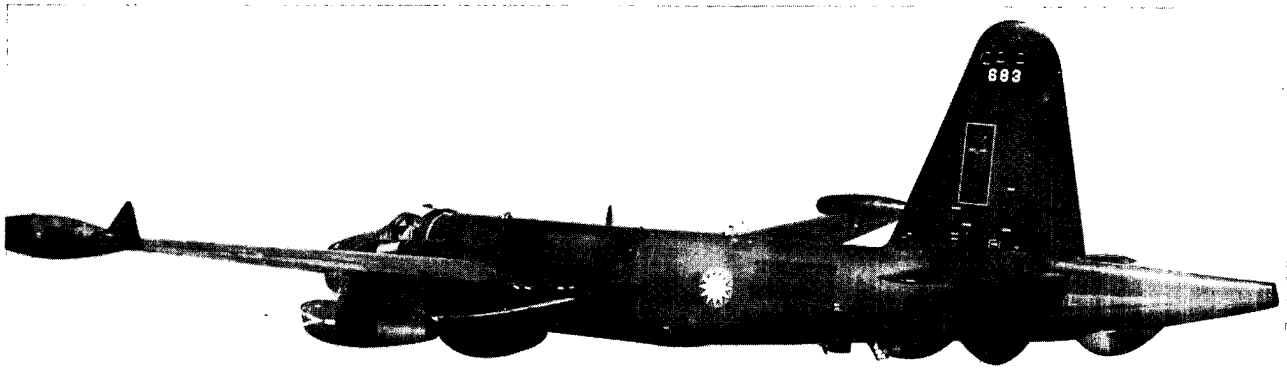
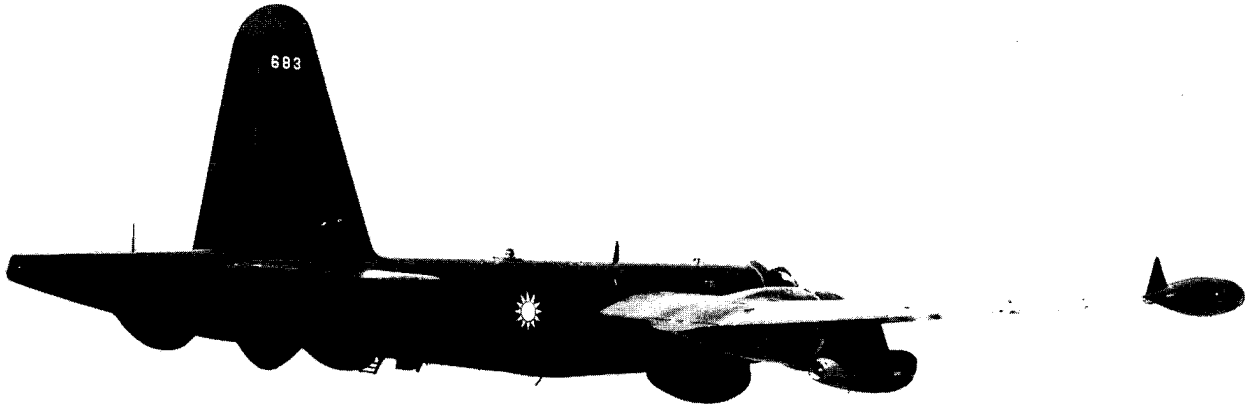










PROJECT CORONA

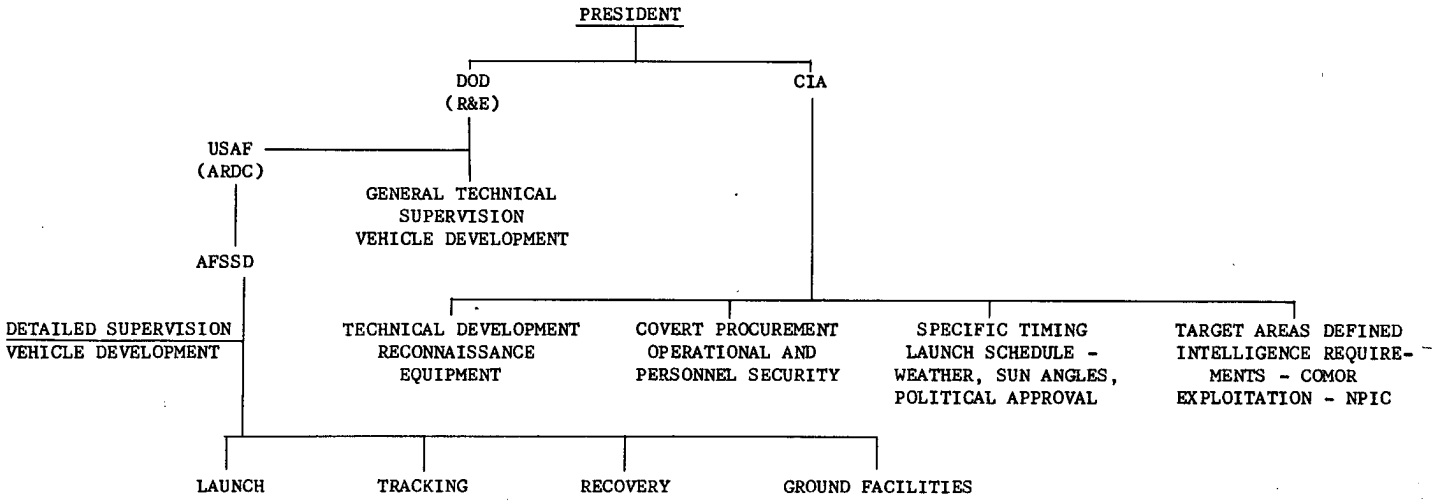
Project CORONA is a joint United States Air Force/Central Intelligence Agency program. The primary objective of CORONA is the covert development and operational use of a photographic reconnaissance satellite incorporating a recoverable capsule.

Prior to initiation of CORONA, the development of such a capability was started by the Air Force as part of Weapons System 117-L. This phase was officially cancelled in March 1958.

Subsequent to the 117-L cancellation the Advanced Research Projects Agency (ARPA) and CIA were charged with the responsibility for administration of the CORONA program, ARPA being responsible for technical direction of vehicle development and CIA being responsible for development of reconnaissance equipment, security, cover and covert procurement.

In November 1959 program responsibility was transferred from ARPA to the Air Force at the direction of the Secretary of Defense. However, CIA retained its responsibilities.

Originally it was planned to limit CORONA to 12 shots and upon completion phase out of the program. Since the initial CORONA program we have had 2 additional follow-on programs and there is a definite possibility of a third follow-on.



SECURITY PROTECTION

PRINCIPLE FACTS TO PROTECT:

A. U. S. CURRENTLY ENGAGED IN A RECONNAISSANCE SATELLITE PROGRAM.

B. CIA IS AFFILIATED WITH SUCH A PROGRAM.

C. THAT CERTAIN SUPPLIER GROUPS ENGAGED IN THE DEVELOPMENT AND MANUFACTURING OF RECONNAISSANCE EQUIPMENT ARE AFFILIATED WITH PROJECT CORONA.

COVER STORY DATA

A. FURTHER DEVELOPMENT OF SYSTEMS AND TECHNIQUES WHICH HAS BEEN EMPLOYED IN OPERATION OF SPACE VEHICLES.

B. PROPULSION AND GUIDANCE TESTING HAVE BEEN THE MAJOR ITEMS OF INTEREST DURING THE INITIAL LAUNCHINGS.

C. DATA ON ENVIRONMENTAL CONDITIONS, USING BIO-MEDICAL SPECIMENS, WHICH WILL BE USED FOR MANNED SPACE FLIGHTS.

D. MUCH OF THE DATA HAS BEEN OF GENERAL SCIENTIFIC INTEREST AND IS UNCLASSIFIED. OTHER DATA INVOLVES NATIONAL SECURITY AND IS CLASSIFIED.

E. NOSE CONE RE-ENTRY TESTS, BIO-ASTRONAUTICS, AND MEASUREMENT OF CERTAIN SUSPECTED SPACE PHENOMENA WILL ALSO BE INCLUDED IN FUTURE COVER STORIES.

Operation

A camera which is to cover an angle of 70° using a long focal length lens (telephoto effect) and designed to render a clearly defined image over the whole negative can employ the panoramic principal of camera design. The camera in this case is designed with a curved focal plane and an oscillating or rotating lens cone. The film remains stationary during exposure while the lens cone sweeps across the emulsion from one side to the other. The end of the cone opposite the lens has a slit in it which permits the light passing through the lens to expose the film. The speed at which the slit traverses the film emulsion and the width of the slit determines the "effective shutter speed" of the camera.

The lens in the "C Triple Prime" camera is a Petzval type lens having a maximum speed of f3.5 and a maximum T stop of 3.8. The relatively high speed and high resolving power of the lens permits the use of advanced film emulsions having very high resolving power (225 plus) but an extremely low exposure index. See page entitled "Camera and Photography".

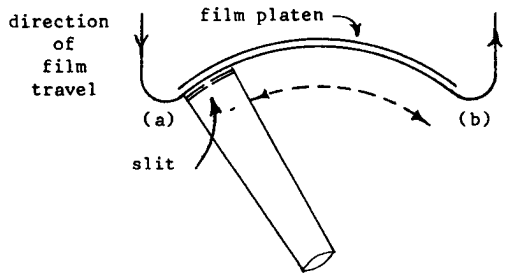


FIGURE A

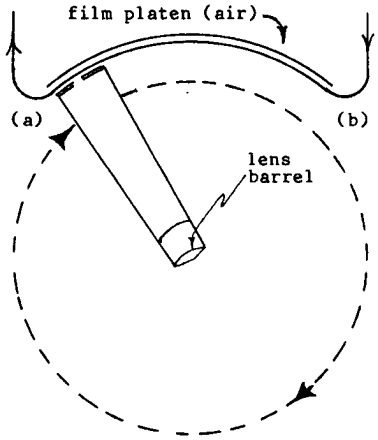


FIGURE B

NOTE: Fig.B is an over simplified drawing of the camera operation. Actually, only the lens barrel rotates 360° while the relatively light-weight "stovepipe" returns to position (a) as in Fig.A

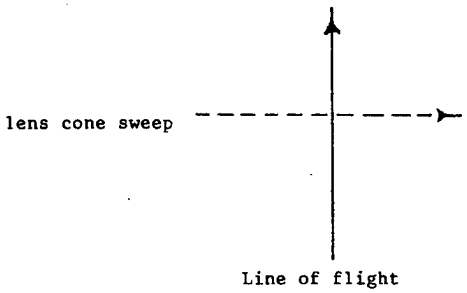
Figure A is a simple diagram of the "C Prime" configuration showing how the lens cone sweeps from (a) to (b), exposing the film. When the slit reaches (b) the slit closes and the cone returns to (a) as new film is fed to the focal plane.

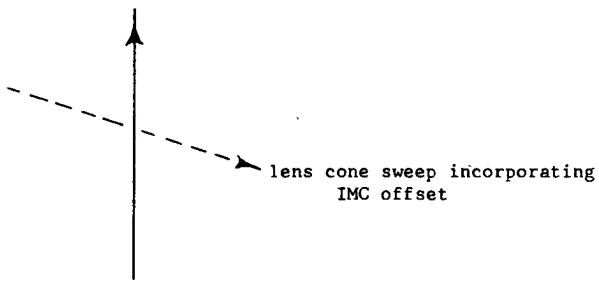
Figure B operates in essentially the same way except the lens cone after passing (b) does not reverse itself to (a) but continues for 360° back to (a).

It was found in the Figure A configuration that when the cone started its sweep a certain amount of torque might be induced on the whole satellite possibly causing a rocking motion both at the start of the sweep and at the stop. The arrangement in Figure B showing the lens cone rotating throughout the operation of the camera would do away with the momentum caused by the start and stop on every sweep and would eliminate possible torque-rocking effect from the camera.

It has now been learned that the torque induced by the oscillating cone is negligible; however, the rotating cone is simpler and more reliable. The vibration in the camera system caused by noise introduced by moving parts during photographic cycle also affects resolution and the rotating cone has been found to be smoother operating and quieter.

The sweep of the lens cone is not perpendicular to the line of flight but slightly off-set to establish an initial compensation for image motion.





The camera has an image motion compensation (IMC) cam. The offset of the panning arc of the camera determines initially the amount of IMC employed for an average altitude during orbit. In addition, the panning or sweep rate affects IMC. Thw sweep rate is regulated by the applied voltage to the lens cone drive motor. The applied voltage to the drive motor is programmed and may be selected by remote command while the vehicle is in orbit. The voltage program system incorporates 11 cams for voltage program selection. After the exact ephemeris and other post-launch data is determined from the vehicle in orbit, the cam most nearly satisfying the desired voltages for the system is remotely activated. If parameters of the orbit change, another cam can be remotely selected to better match the new set of orbital parameters. The IMC is changed by programming prior to launch, and each pass both ascending and descending has a programmed IMC. This program is perforated on the same 11 channel 35 mm mylar tape as the on-off schedule.

If IMC is not synchronized with image motion, the image will move while the shutter is open causing some degree of blurred image and a loss of film resolution.

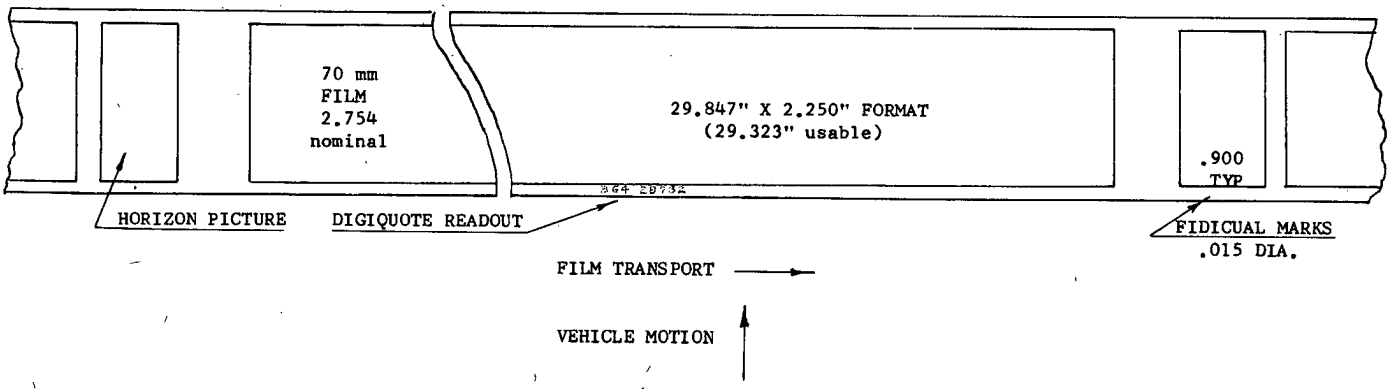
CAMERA AND PHOTOGRAPHY

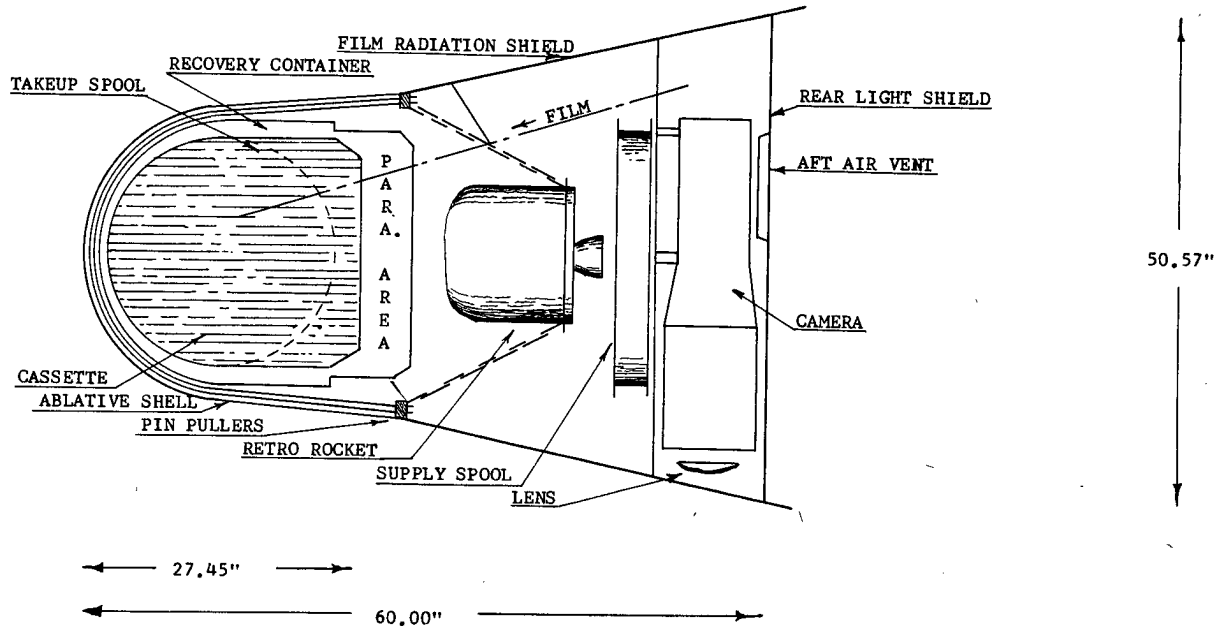
Three photographic negative materials have been used in the CORONA cameras thus far. These are 70 m.m. films and are listed below:

Material	Code	E-I Speed	Base	Resolving	Camera
Plus X	SO-102	64	Estar	95	C
Pan X	SO-130	20	Estar	160	C Prime
Exp. Hi Definition	SO-132	1.6 (?)	Estar	225+	C Triple Prime*

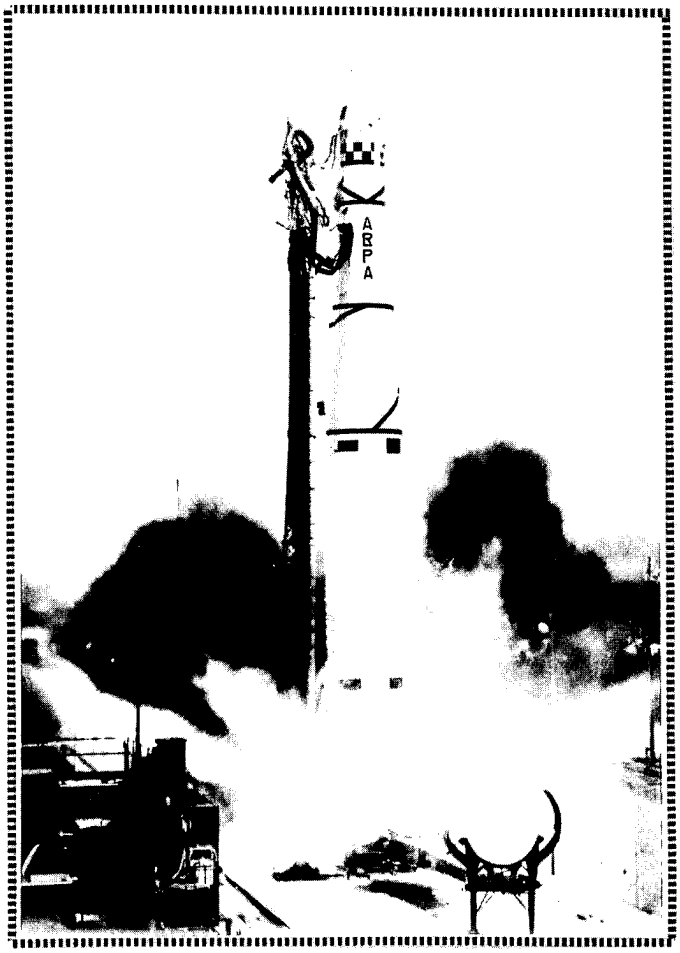
* July or August 1961

FORMAT OF CORONA CAMERA PICTURE





1. Camera: HYAC Type (Panoramic), C, C Prime, C Triple Prime
2. Film size: 70 mm
3. Focal length: 24 inches
4. Film Capacity: 7,600 feet (41.8 lbs including spool), 26,000 N.M.
   15,200 feet (MURAL), 26,000 N.M.
5. Scale Photography: 1:300,000 (approx.)
   Resolution: 15 feet plus or minus 10 feet depending on camera, film, sun angle and altitude



Total Weight - 124,122 lbs

Payload - 440 lbs (195 Recoverable)

Height - 81.2 ft

Thrust (1st Stage) - 169,000 lbs

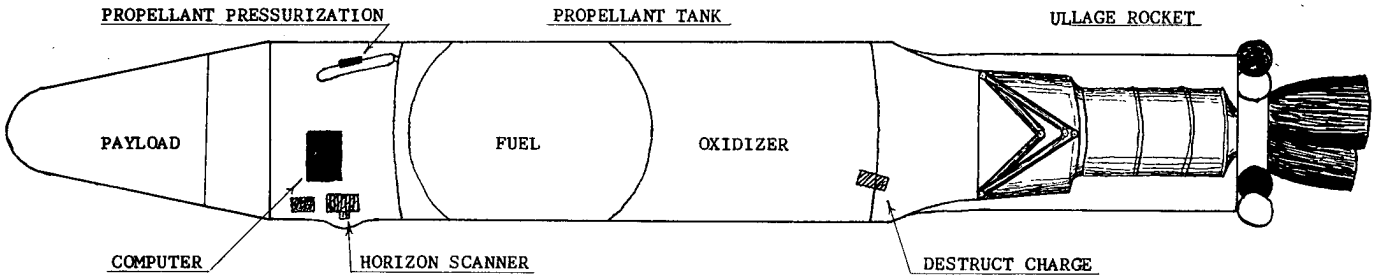
(2nd Stage) - 16,000 lbs

Engines THOR-AGENA

Orbit Time - 91.6 minutes (approx)

Altitude (average) - 150 miles

VEHICLE INBOARD PROFILE



RECOVERY OPERATIONS

1. TIMER TURNS ON RE-ENTRY CAPSULE TELEMETRY AND BEACON FILAMENTS

1 SECOND

2. PROVIDE MAX. TELEMETRY AND BEACON SIGNAL STRENGTH

18 SECONDS

1 SECOND

3. EJECT COMMAND - CAPSULE EJECTS

75.5 SECONDS

11 SECONDS

4. SPIN ROCKETS FIRED

2.75 SECONDS

5. RETRO ROCKETS FIRED - DECELERATION - DESCENT

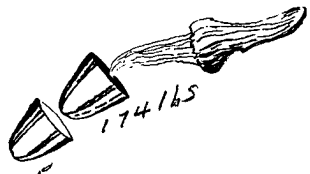
153 SECONDS

6. DE-SPIN ROCKETS FIRED - POSITION CAPSULE FOR RE-ENTRY

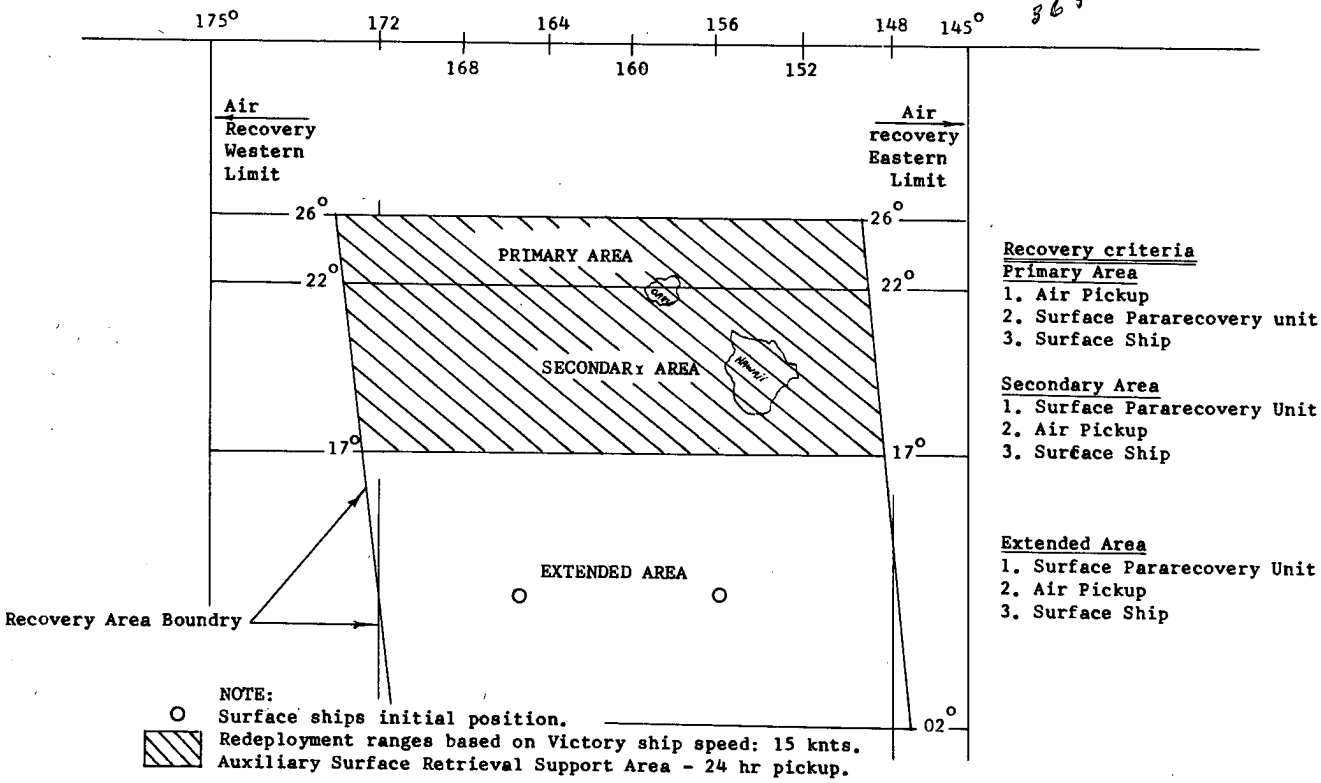
7. THRUST CONE SEPARATION TELEMETRY CEASES. BEACON SIGNAL TRANSMITTED.

8. ABLATIVE SHELL BURNS. BLOCKS BEACON SIGNAL. 180,000 FT. TELEMETRY TURNED ON AGAIN.

9. PARACHUTE DEPLOYED - ABLATIVE SHELL EJECTED. CHAFF RELEASED, BEACON SIGNAL, FLASHING LIGHT ENERGIZED.



PAYLOAD RECOVERY AREA

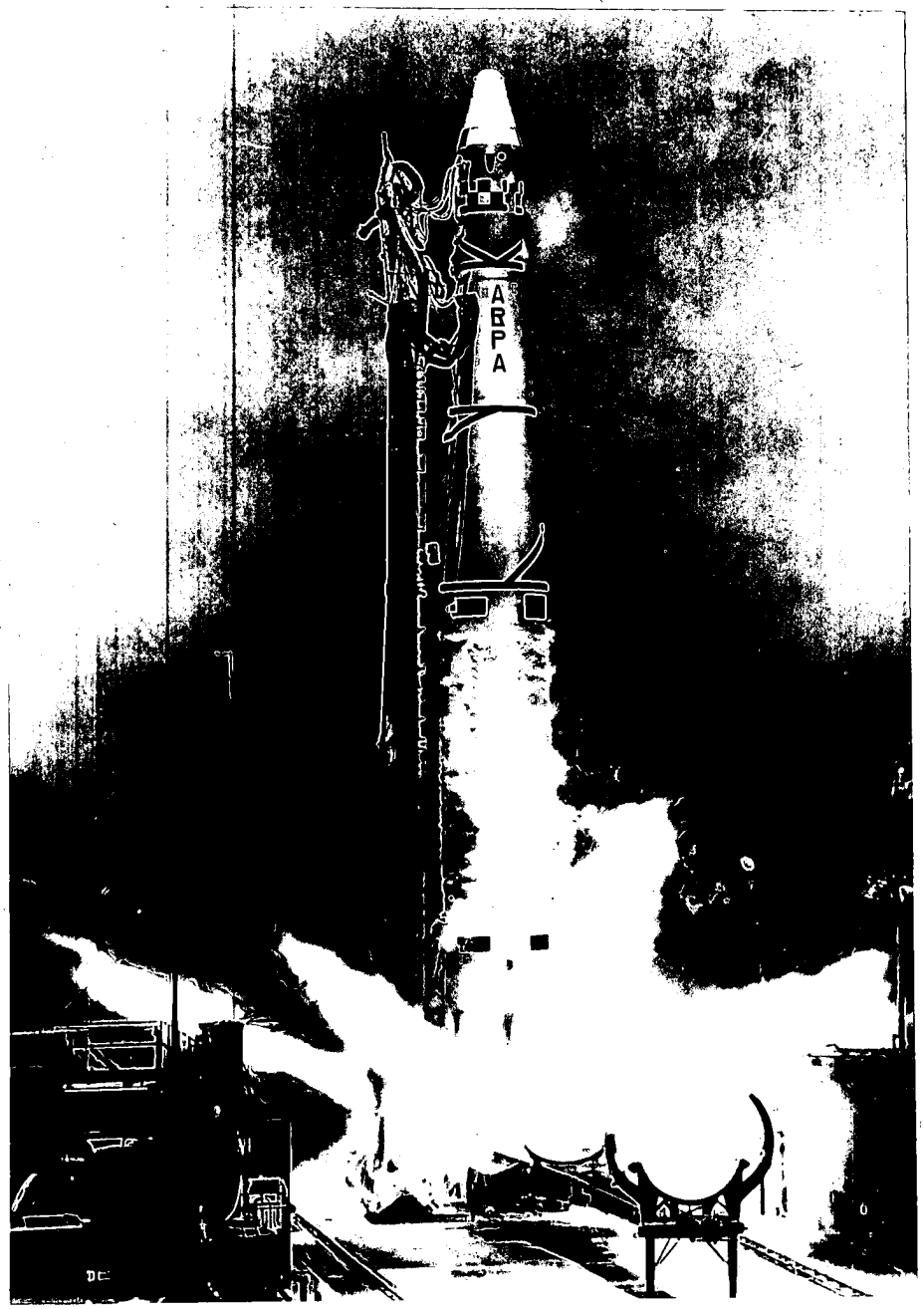


Recovery criteria

Primary Area
1. Air Pickup
2. Surface Pararecovery unit
3. Surface Ship

Secondary Area
1. Surface Pararecovery Unit
2. Air Pickup
3. Surface Ship

Extended Area
1. Surface Pararecovery Unit
2. Air Pickup
3. Surface Ship



OBJECTIVES SATISFACTORILY DEMONSTRATED TO DATE

A. Achieved orbit
B. Cognizance and control of satellite equipment during orbit
C. Air and surface recovery of re-entry nose capsule for direct examination
D. Ground-space communications achieved
E. In-space command capability achieved
F. High resolution satellite photography achieved.

FUTURE OBJECTIVES FOR CORONA FLIGHTS

A. Better control of satellite equipment during orbit
   1. More precise orbital tracking
   2. Vehicle orbit capability exceeding 4 days
B. Higher resolution photography (better than 5 feet)
   1. Color, Infra-red
   2. Stereo coverage

VEHICLE PRODUCTION

1. Manufacturing Jig
   a. Spaceframe fabrication
   b. Vehicle assembly
2. In-plant vehicle checkout
   a. Design improvements
   b. System and subsystem checkout
3. Santa Cruz Test Base
   a. Hot firing
   b. Vehicle acceptance
4. Launch Base (Vandenberg AFB)
   a. Final vehicle checkout
   b. Mating with booster
   c. Launch
5. Contractors

There are 5 major contractors engaged in the CORONA effort.

a. Lockheed Missile Systems Division, Lockheed Aircraft Corporation is a prime contractor for the "C" Prime, "C" Triple Prime and MURAL programs. LMSD developed the second stage AGENA which is used in the CORONA program. Assembly of the complete recoverable capsule is accomplished at the Hiller facility, Palo Alto, California. The entire building is a secure area and is under the cognizance of [redacted] a CIA Security Officer permanently assigned to the project. There are approximately 250 cleared personnel in the LMSD complex and approximately 70 in process for clearance. 25X1 25X1

b. The Eastman Kodak Company, Rochester, New York, as a prime contractor for "C" Prime, "C" Triple Prime and MURAL is engaged in film development and processing. Mr. Duncan MacLeod, a CIA Security Officer has been permanently assigned to EK and is responsible for security within the CORONA secure area. There are approximately 110 CORONA cleared personnel at EK.

c. The Itek Corporation has two facilities wherein CORONA work is carried on. The main facility at Lexington, Mass. and their West Coast plant in Palo Alto, Calif. Itek was responsible for designing the camera used in the "C" prime facet of CORONA. The cameras to be used in the "C" triple prime and MURAL are designed and fabricated by Itek. Our security contact at Itek, Lexington, is [redacted] 25X1 [redacted] is the West Coast contact. There are approximately 110 CORONA cleared personnel at Itek.

d. The General Electric Company, Philadelphia, Pa. designed and manufactured the recoverable capsule. This is the same capsule used on the "white" Discoverer shots, however, certain modifications are made in a secure area at GE. [redacted] 25X1 [redacted] GE security officers are our primary contacts. There are approximately 260 CORONA cleared personnel at GE. 25X1

e. The Faichild Camera and Instrument Company, Syossett, New York fabricated the CORONA "C" prime camera under a sub-contract to Itek. FCIC will not be involved in the "C" triple prime or MURAL programs. Our principle security contact at FCIC is [redacted] There are approximately 260 CORONA cleared personnel at FCIC. 25X1

PROBLEMS ENCOUNTERED

1. Attaining most effective orbit
   Consistantly obtaining desired apogee and perigee
2. Maintaining gas pressures for stabilization
3. Better controlled and more accurate recovery

Programming

The camera is electrically driven and operates as long as the system circuit is closed. Perforated 35 mm mylar program tape is programmed by punching out. Electrical contact is permitted through holes in the tape and when a closed circuit exists the camera continues to operate. In addition, the camera can be controlled from ground control stations while the vehicle is in orbit. This control is limited, however, and presently is confined to the elimination of a certain pass or passes within range of the control station. Each tape is over-programmed to permit elimination of photography over areas of known bad weather or where previous days' coverage was considered adequate. The whole pass must be eliminated, that is, portions of a programmed pass cannot be turned on or off at will at the present time.

The Committee on Overhead Reconnaissance (COMOR) levies requirements on the Agency or Department of the Government with the capability of obtaining the desired coverage; in this case, CIA/DPD. DPD then plots the COMOR targets by latitude. These on-off points are sent to the CIA representative at Lockheed Space Missiles Division, Palo Alto, California. The programmer then punches the program tape for the camera and the system is checked out prior to launch. Lockheed requests the on-off points 21 days prior to scheduled launch.

Limitations and Considerations

The launch and orbit of a semi-controlled vehicle is still a relatively new and uncertain science. When there have been sufficient general verified laws accumulated to better permit more precise launch and orbital control, and desired ephemeris can be had on each launch, then the overall average of the scale and quality of the photography will be enhanced. At present we strive for a desired altitude of 120-150 miles over target. However, inclination angle errors and other controlling effects are introduced which do not always permit us to obtain best altitude. Better control is to be had through frequent launchings, and the state of the art has come a long way since the first vehicle was launched.

The amount and quality of photographic coverage in the Northern latitudes that can be obtained by the CORONA vehicle varies as the time of year. During the summer months the sun-angle or amount of light illuminating the earth's surface at, say 70°, is sufficient to obtain quality photography with high resolution and good contrast. As winter approaches the sun-angles become smaller in the Northern latitudes and faster films must be used to obtain photographic coverage even at 50° North latitude. Initially a sun angle of 15° minimum for the "C Triple Prime" employing slow speed high resolution film and 7° for the "C Prime" cameras and faster films have been established. Until further evaluation is made of the "C Triple Prime" camera and the new film, the sun angles selected are considered valid. The launch time limits are governed primarily by the following factors: sunset on day of planned recovery, time of the vehicle on the pad, temperature variations and limitations both on the ground and aloft, the color of the vehicle facing the sun, and the readiness of the vehicle at count-down time. Recovery is planned for about three hours prior to sunset, and to program the recovery for a specific day, time, and area, necessitates a launch time limit of approximately two hours. The other factors listed above will also affect launch time for reasons not mentioned here.

The sun angle and season will affect the resolution of the film obtained from CORONA. In the winter months at low sun-angle, the resolution in Northern latitudes is poor and in some instances has been so poor that very little value from an intelligence standpoint can be obtained. With good sun-angle, clear sky, optimum conditions of orbit, camera function, and best possible development of film a good resolution of about 15 feet and, at times even 10 feet, may be obtained.* Compared with photography from a high-altitude manned aircraft, the CORONA film is in a different category. First, the scale of CORONA negatives averages about 1:300,000, whereas the high-altitude reconnaissance aircraft film material is far superior. Tactical information cannot be had from CORONA material but can be had from the film from the U-2. Even the latter is limited in tactical data compared to a military reconnaissance aircraft flying at 10 to 20,000 feet. It is important that the consumer and those making policy decisions concerning this matter should be thoroughly aware of the large differences in these three systems of aerial reconnaissance and appreciate the loss or gain of intelligence when employing any one of the systems.

* Resolution of film is not a nebulous expression but one which has been used in regard to the CORONA and IDEALIST programs without the respect it deserves. The most accurate system for determining resolution of overhead photography is to pass the camera over a ground area which includes a resolution chart. The resolution ground chart consists generally of painted panels laid out on the ground. The area, shape, size, color and dimensions of each panel is very important, and expensive. The cost estimate for such a resolution ground chart installation at Edwards AFB was made at $275,000. The chart would not be just for CORONA evaluation but for any other similar satellite coverage, high-altitude manned photo planes such as U-2 and any military reconnaissance aircraft both in existence and in the planning stage. For a realistic and accurate evaluation of resolution for comparison purposes, the cost of such a resolution chart installation might be well worth while.

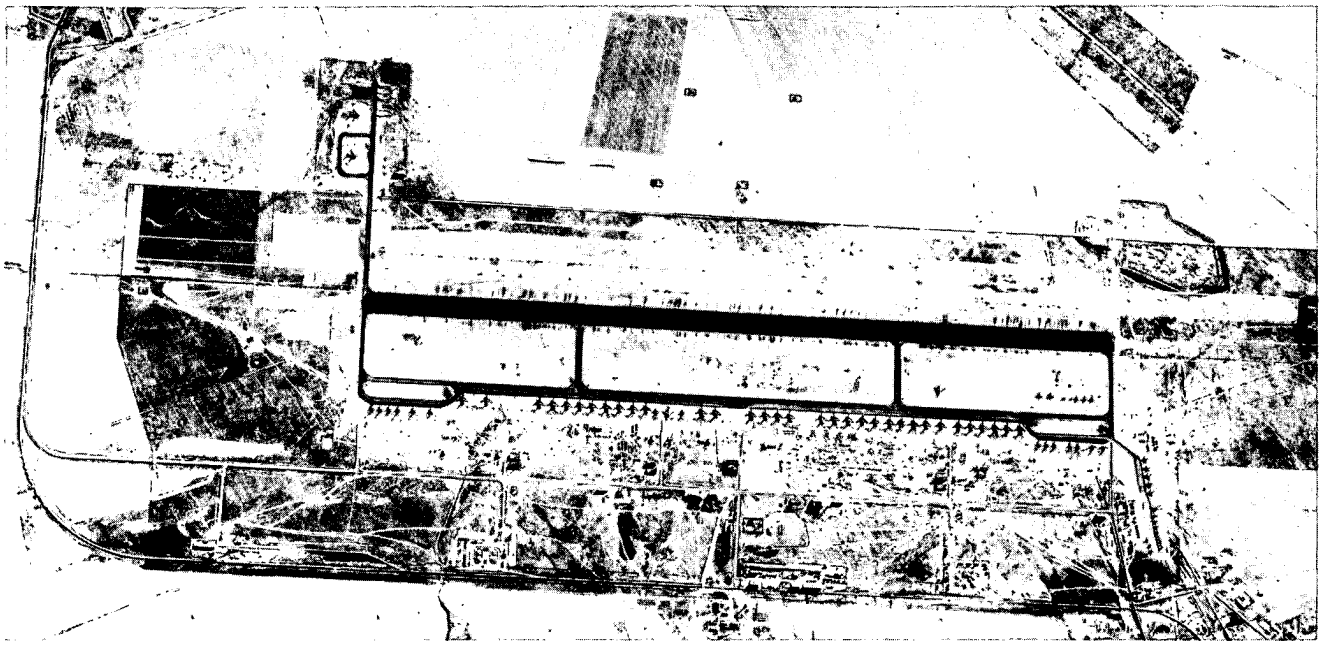


FIG. A

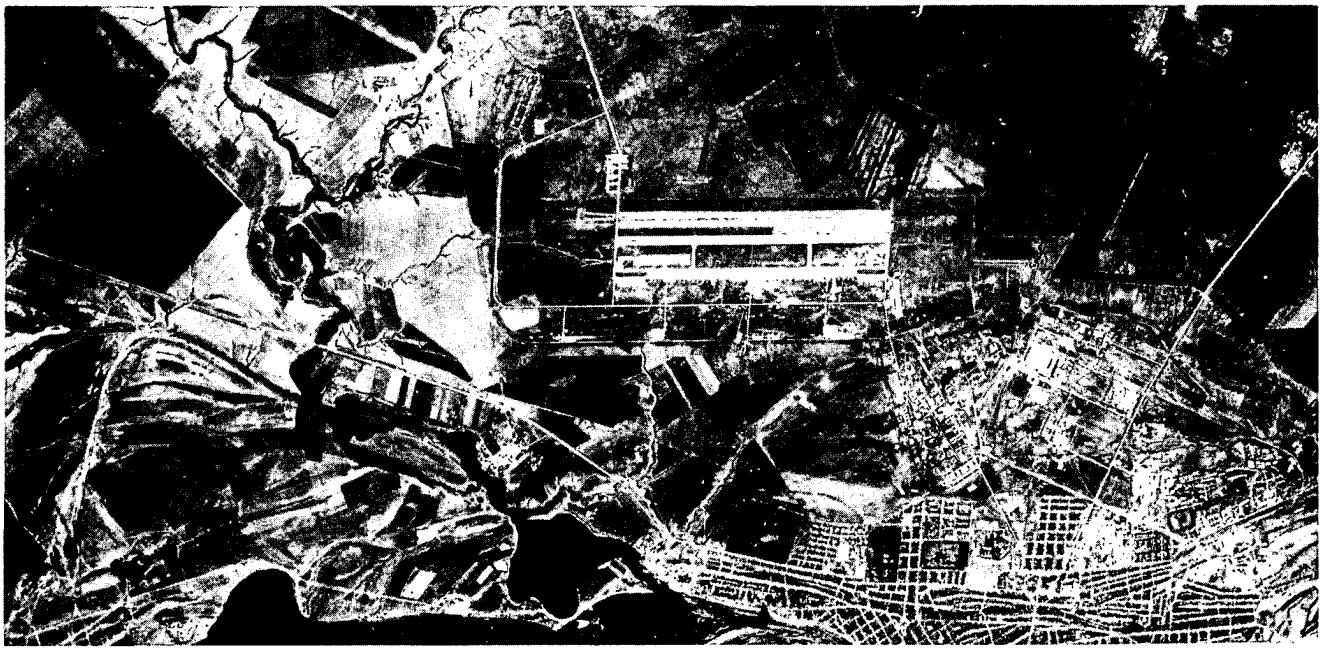


FIG. B

COMPARISON OF TALENT AND KEYHOLE PHOTOGRAPHY

Figure A is a portion of a 9 x 18 inch contact point covering Saratov-Engels Airfield. The picture was taken by a U-2 on 6 December 1959 at approximately 70,000 feet. Figure B is a seven diameter enlargement of the same area as Figure A but taken with a 57 x 758 mm format camera positioned in the CORONA vehicle. Figure B was taken 16 June 1961 at about 140 miles altitude. The important thing to note here is the comparison in resolution and detail. The "B" configuration in the U-2 produces far superior results but a much greater risk to the vehicle. The "C" camera in the CORONA vehicle covers many more square miles in each picture, is much less of a risk but obtains less resolution and detail. Both prints were made from third generation negatives. The "C triple prime" camera now being used produces a much finer image than that in Figure B.

GROUND SUPPORT FACILITIES

Facility	Equipment*	
Satellite Test Center	ABCD	Over-all control, orbit computations and predictions, acquisition data for tracking stations, prediction of recovery area.
Vandenberg AFB Tracking Station	BDEFGHIJ	Ascent and orbital tracking, telemetry reception, trajectory measurements, command transmission.
Mugu Tracking Station	BDEFGHI	Ascent tracking, telemetry reception, computation and transmission of ignition and shutdown corrections.
Downrange Telemetry Ship	BGIJK	Telemetry reception and tracking during ascent and early part of first orbit.
New Hampshire Tracking Station	BDFGHIJ	Orbit tracking, telemetry reception, commands to satellite.
Kodiak Tracking Station	BDFGHIJ	Orbit tracking, telemetry reception, initial acquisition on pass 1, monitor events in recovery sequence.
Hawaiian Tracking Station	BDFGHIJ	Orbit tracking, telemetry reception and transmission of commands to satellite.
Hickam AFB Oahu, Hawaii	D	Over-all direction of capsule recovery operations.
Tern Island	BGHJ	Recovery capsule tracking.

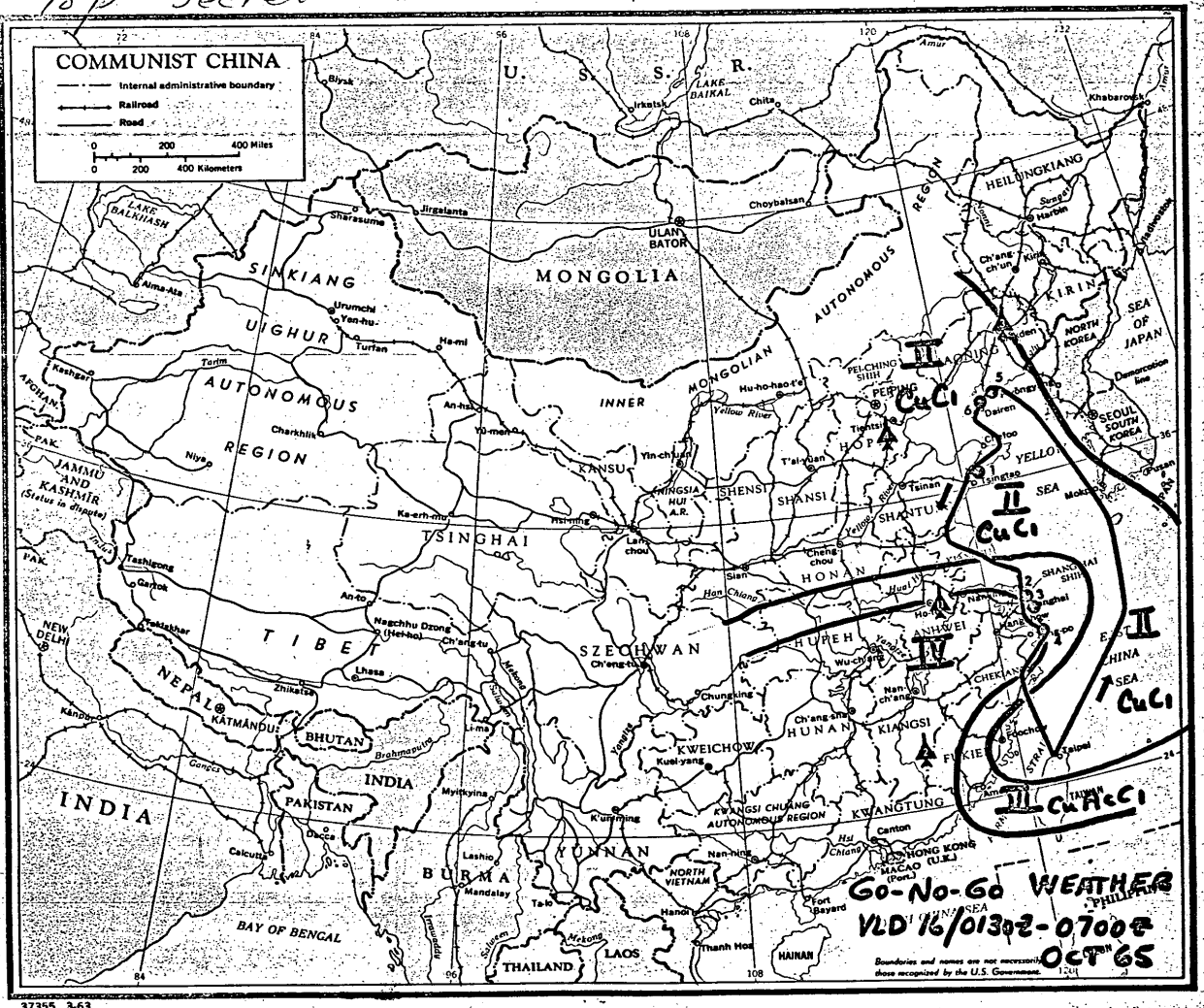
NOTE: In addition to equipment listed, all stations have inter- and intra-station communications equipment and checkout equipment.

* Equipment

A. General Purpose Computer(s) and support equipment
B. Data Conversion Equipment
C. Master Timing Equipment
D. Control and Display Equipment
E. Guidance and Command Equipment (DISCOVERER ascent only)
F. VERLORT
G. VHF FM/FM Telemetry Station
H. VHF Direction Finding Equipment
I. Doppler Equipment
J. VHF Telemetry Antenna
K. APL Doppler Equipment

Top Secret

FOR OFFICIAL USE ONLY



37355 3-63

C535C
16 Oct 1965
Field Readout

2064 NM 112B
5+20 Hours

Entry Altitude: 69,000
Profile: Max. Alt.

Top Secret

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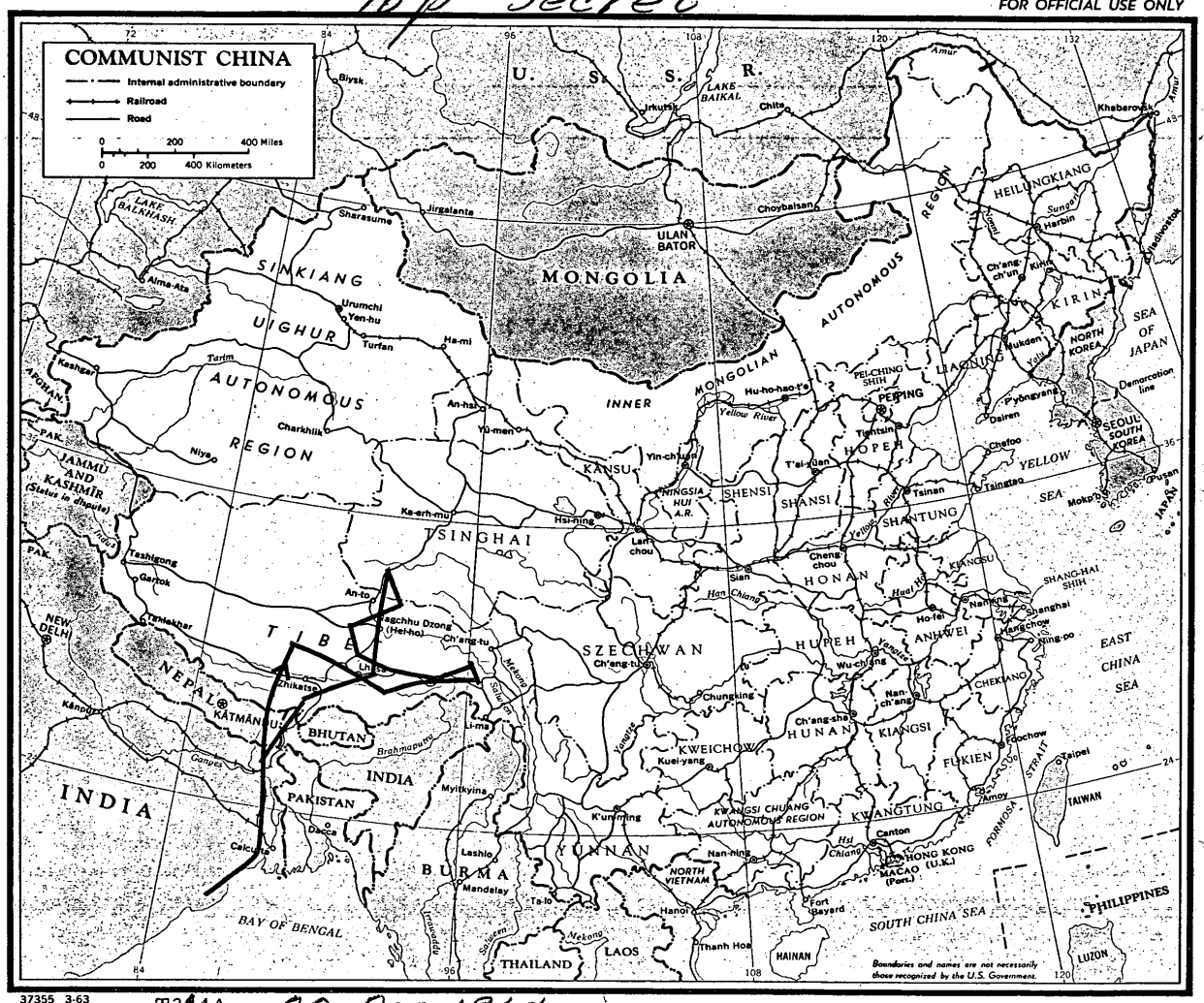
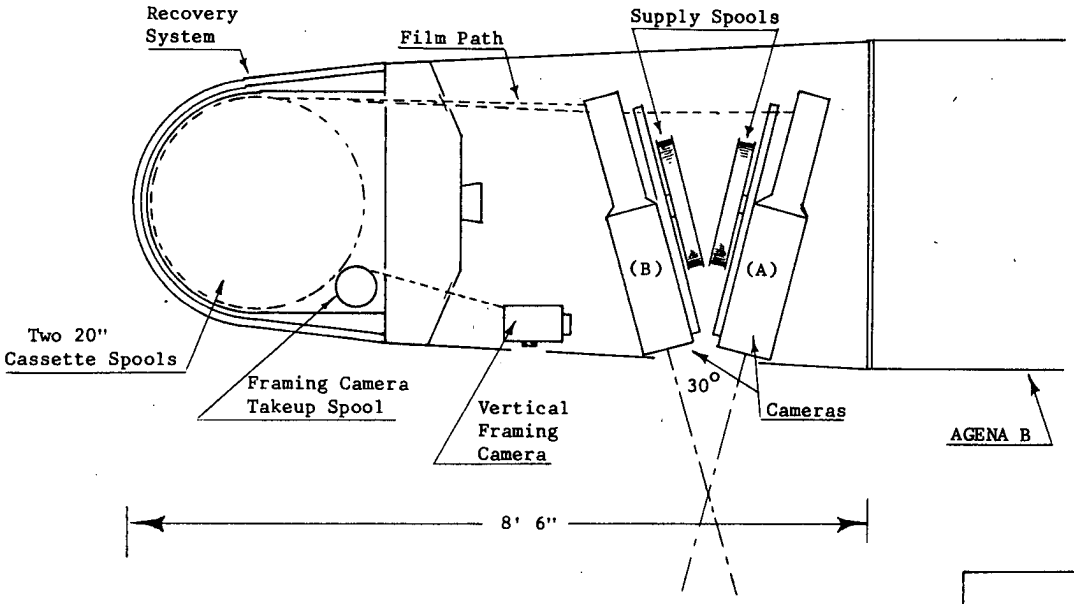
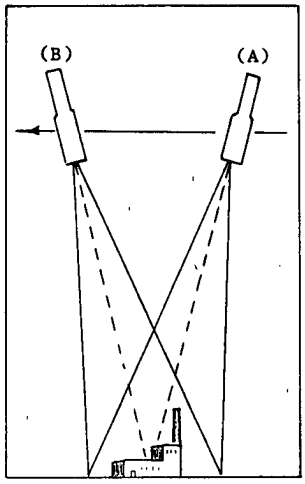


37355 3-63

T344A 20 Dec 1964
2561 NM
6+ 53 hours

MURAL CAMERA CONFIGURATION (1962)





The MURAL configuration for satellite photography employs two cameras each essentially a C''' CORONA camera. The two camera modules operate in a similar manner to the CORONA camera and they are offset from the verticle axis by fifteen degrees forming an intersecting optical axis of thirty degrees. The camera (A) firing forward covers a certain terrain area and the same area is covered by camera (B) a short time later, but from a different verticle aspect. (See sketch.)

This system photographs areas of interest with stereo coverage which permits a more detailed product for easier and more accurate readout by the Photographic Interpreter. It is particularly valuable when the objects are photographed with a very low sun-angle (7^{o}-15^{o}) and the shadows are too long to aid the P.I. in interpretation. Interpretation of detailed objects is much easier and more accurate, and positive intelligence can be obtained.

The design parameters of the cameras are the same as CORONA except the mechanics of the film track, additional film spools and double the film capacity (2 x 7600) or 15,200 feet total. The framing camera also is carried in this vehicle for system orientation purposes. When the film is recovered the film cassette is opened and film from each camera removed from the three-flange spool and packaged into two containers. Couriers will deliver packages separately to Eastman Kodak in Rochester for processing, each courier travelling on different aircraft for security of the product.

The IMC and film programming are somewhat different and more flexible than the CORONA System. More latitude is allowed in the film programming to permit coverage over clear targets and eliminate waste of film over cloud covered areas. Also, more flexibility and reliability are available in the ground command procedures and control systems.

The MURAL System is an important step forward in the art of satellite photography. Stereoscopic photographic coverage, high resolution through use of the C''' cameras and improved films produces a product far superior to anything the intelligence community has had available through satellite photography in the past.